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THE

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1897—No. 5.

SILT DEPOSITS.

(CANAL SILT.)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. VI., Pt. III., S. 2204a.*]

THE VALUE OF SILT AS A MANURE.

A Note on some Experiments which have been made to test the Value of Canal Silt. By DR. J. W. LEATHER, *Agricultural Chemist to the Government of India.*

Other DICTIONARY articles that may be consulted:

Mineral Manures, *Vol. V.*, M. 255.

Oryza sativa (*Silt deposits in India*) *Vol. V.*, O. 310.

Reh, *Vol. VI., Pt. I.*, R. 67.

Sand-binding Plants, *Vol. VI., Pt. II.*, S. 774.

also

The Agricultural Ledger Nos. 1 of 1893 and 16 of 1894.

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THE VALUE OF SILT AS A MANURE.

A Note on some Experiments which have been made to test the Value of Canal Silt. By DR. J. W. LEATHER, *Agricultural Chemist to the Government of India.*

Early in 1893, at the suggestion of **Sir Edward Buck**, experiments were commenced to test the manurial value of the silt which is generally carried on to the land by canal water.

2. It was first attempted to carry out the investigation as a field experiment. Fields were embanked and the canal water run on during the monsoon. A crop was then taken in the following cold weather from this as also from a contiguous field to which no canal water was applied during the monsoon.

The first field on which I attempted to make the experiment was one taken up, with the permission of the Superintendent of the Dun, by the Tahsildar. The soil was very stony and the bunds could not be made strong enough to withstand the pressure of the water. Three attempts were made, but each time the bunds broke and I had to give up the experiment on this land.

Concurrently with this I had availed myself of the offer of two native gentlemen, who had some land in the Eastern and Western Dun, respectively, to take up plots of their land, and in these cases I was successful. The canal water was run on rather later than I had wished, but still it was successfully applied.

The experiment was made at two places, one in the Western and the other in the Eastern Dun. The land in the Western Dun was divided into two plots, A and B. Plot A had an area of 797 square yards and received no canal water; Plot B had an area of 855 square yards, and was treated with canal water five times during the monsoon. Both plots were sown with oats at the rate of 8 seers per bigha or 74 lb per acre—Plot A on 15th October 1893 and Plot B on 21st

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October 1893. The outturn from these plots was: Plot A 338lb per acre, Plot B 388lb per acre. The land in the Eastern Dun was divided into three plots, A, B, and C.

	Area, square yards.	Treatment.	Grain, lb per acre.	Straw, lb per acre.
A	738	Unsilted.	597	1,279
B	880	Silted.	627	1,100
C	747	Unsilted.	635	1,237

Plot B was situated in the middle, between the other two plots. Canal water was applied to Plot B four times. They were all sown with wheat on 18th November 1893 at the rate of 8 seers per bigha or 74lb per acre.

Comparing the results, it will be seen that the produce of the "silted" plot in the Western Dun is somewhat larger than that of the plot which received no silt, but that the results obtained in the Eastern Dun are not concordant, the outturn of Plot B standing midway between that of the other two plots. The differences are, however, not very great in any case.

3. The experiments are not altogether free from certain difficulties in their execution, and a note of one or two of these may be added.

The first field taken up for the purpose of these experiments had to be abandoned, because the bunds would not stand the pressure of the water. The land was fairly light and stony similar to much of the land in the Dun, and it is just on such land that the greatest benefit from an application of silt would usually be experienced. It is, therefore, to be regretted that the bunds could not be made to withstand the water-pressure. But it is also to be noted that this difficulty would be equally experienced by the cultivators. If bunds are so weak that they cannot be fairly trusted to hold water, they only prove a source of risk to other crops which might be damaged by water flowing on to them. No doubt, too, the cost of keeping up bunds made of light soil would be considerable.

The land on which the two experiments were eventually successfully carried out was of a much stiffer description, and no difficulty was experienced in keeping the water in the "kiaries." The amount of silt in two samples of the canal water was 28 and 131 grains per gallon, respectively.

So far as I can estimate about 10lb of Phosphoric acid and 10lb of Nitrogen would be supplied per acre in the water from which the second sample was taken. This is not as much as would be taken out of the land by an ordinary crop of wheat, but would probably supply more than half the deficiency.

The amount of plant food is, therefore, not by any means considerable, and one could not in any case expect a very large increase of outturn from its application.

That it has an agricultural value there can be no doubt, and this is exemplified in the case of rice lands, which are annually treated with deposits of canal silt from the water used for irrigation. On the other hand, there are difficulties in carrying out the experiment on light land, which is just the description of soil which would be usually most benefited by an application of silt. Again, if the silt be supplied to heavy land, the benefit is proportionately small, and the increased outturn of grain could not be expected to be large. Consequently, it becomes doubtful if the method would show the real value of silt sufficiently accurately.

4. Owing to the difficulty of demonstrating the value of canal silt by means of such field experiments as the above, it was decided to test the question by means of the chemical analysis of the silt in known quantities of water. These multiplied into the quantity of water applied to the land, which is regularly estimated by the Irrigation Department, give the amount of fertilising matter per acre.

Accordingly samples of water have been regularly supplied, the silt weighed and the Nitrogen, Phosphoric acid and (in one series) the Potash determined in it.

The following reports embody the results obtained—

5. (Copy of a letter No. 197, dated 25th September 1895, from the Agricultural Chemist to the Government of India, to the Executive Engineer, Upper Division, Eastern Jumna Canal, Saharanpur.)

With reference to the canal water samples with which you have supplied me during the last year from the Upper Eastern Jumna Canal, I have now the honour to submit in the accompanying statements the results of the analysis and the deductions which may be drawn therefrom.

There are two samples for the months of June and July, respectively (1894 and 1895). In the case of that for June 1894, the sample was drawn after the commencement of the monsoon, whereas that for June 1895 was collected *before* the rains had set in. This will explain the wide difference which existed between the amounts of silt in these two samples. The amounts of silt in the two for July seem to agree fairly well.

It will also be seen that, as might have been anticipated, the quantity of silt decreases from the end of the rains throughout the hot weather.

There was not sufficient silt in each sample for the separate determination of Potash, Phosphoric acid and Nitrogen, but the silt of the different samples was collected and one complete analysis made. From this and the quantity of silt, together with the depth of water which was used on the land, the amount of each of these several plant foods, Potash, Phosphoric acid and Nitrogen which are carried on to the land at any season of the year, may be calculated.

The figures now submitted in Statement 2 must not, however, be

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considered as more than approximate. One analysis of silt is hardly enough to go upon, and for the quantity of water put on the land during the different seasons of the year, I have had to refer to the Irrigation Revenue Report for 1893, *i.e.*, the year previous to the one during which the samples have been calculated. But the figures in Statement 2 have nevertheless an approximate value, and probably indicate the extent to which canal silt on this particular canal is manuring the land.

STATEMENT No. 1.

Amount of Silt in the Water of the Upper Eastern Jumna Canal.

Sample No.	$\frac{373}{92\text{-}94}$.	$\frac{381}{92\text{-}94}$.	$\frac{331}{95}$.	$\frac{385}{92\text{-}94}$.	$\frac{392}{92\text{-}94}$.	$\frac{397}{92\text{-}94}$.	$\frac{419}{92\text{-}94}$.	$\frac{168}{95}$.	$\frac{183}{95}$.	$\frac{212}{95}$.
Date .	21st June 1894.	17th July 1894.	10th July 1895.	8th August 1894.	20th September 1894.	17th October 1894.	5th December 1894.	3rd April 1895.	8th May 1895.	4th June 1895.
Parts of Silt per Million of Water	1,500	2,138	1,811	10,575	1,294	677	648	321	343	171

STATEMENT No. 2.

Amounts of Plant Food supplied per acre.

	Kharif.	Rabi.	Whole year.
	lb per acre.	lb per acre.	lb per acre.
Potash	154	19·6	54·6
Phosphoric acid	42	5·2	15·0
Nitrogen	31	3·8	10·8

The crops principally irrigated by this canal at the different seasons are rice in the kharif, wheat in the rabi, whilst sugar-cane is the principal crop which occupies the land all the year round. The amounts of the plant foods supplied in the kharif are probably sufficient for the entire rice crop; but during the rabi they are not sufficient for the wheat, and the deficiency is probably still greater in the case of the sugar-cane.

I have had the advantage of personally discussing these results with Mr. Ward Smith, and he thinks that it would be well to carry out a similar and at the same time more complete set of analyses during the next twelve months. Since the three principal crops irrigated are rice, wheat and sugar-cane, the samples taken should have reference to the months during which the water is used for these three crops.

Then, too, the amount of water supplied to these crops can, he thinks, be estimated more exactly than by reference to the figures in the Irrigation Revenue Report. For example, "mean depth of water supplied during the kharif" has reference to the six months April-September, and is not the same as the depth used for rice. I need not enter further into this question, as you will be able to deal with it.

As to the samples of water, I will have 8 Winchester Quarts fitted up in two boxes, and these I will send to you. They should all be filled for each sample, and in this manner I shall be able to obtain sufficient silt to make the necessary chemical determinations. I would suggest, however, that the eight bottles might with advantage be filled at different hours during two or even four days, so as to allow for odd variations in the state of water.

The samples may be taken about once a month though, I dare say, an advantage would be gained if the dates for collecting them were fixed rather according to the particular crop which is being irrigated. For example, a sample taken early in June might have reference to the sugar-cane crop but not to the rice crop, whilst one taken at the end of June would have reference to the rice but not to the sugar-cane. This is, however, also a question which you can

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better decide than I, and I will merely ask you to inform me what you would recommend to be done.

6. During July and September 1894 several samples of water were taken from the Bijapur canal, Dehra Dun, but the year was abnormally wet, and I understand from Mr. Dupuis that the amount of water taken for the rice was correspondingly low. I do not think that the results are worth quoting.

7. (Copy of a letter No. 190, dated 23rd July 1896, from the Agricultural Chemist to the Government of India, to the Executive Engineer, Upper Division, Eastern Jumna Canal, Saharanpur,)

With reference to the experimental determination of the value of canal silt, I have the honour to submit the results obtained by the analysis of the samples obtained last "rabi."

Owing to an accident the silt in the sample taken in February was destroyed.

It will be seen from the accompanying statement that, although there was less silt in the sample collected in April than in that collected in December, the amount of Nitrogen and Phosphoric acid per million parts of water afforded by the two samples did not differ very greatly. Since the February sample was lost, I have taken the mean of these two samples to represent the silt in the "rabi" season canal water. The amounts of Nitrogen and Phosphoric acid are very small, but since the rainfall generally was so light during the cold weather, it is probable that in an average year the proportions of these plant foods would be greater.

STATEMENT.

Sample No.	Date.	Parts of silt per million of water.	Nitrogen.	Phosphoric acid.
$\frac{8}{1\cdot6}$	December 1895 .	167	·06012	·182
$\frac{8\cdot1\cdot8}{9\cdot6}$	14th-18th April 1896	60	·077	·130
		Mean of the two samples.		
		113	·068	·156

The mean depth of water applied to the land was 2·59″ which is equivalent to 7,029,000lb of water per acre.

Thus the amount of Nitrogen supplied by the silt was ·478lb per acre and of Phosphoric acid 1·101lb.

8. The results of similar determinations of the value of silt on the same canal during the year 1896-97 are as follows. For the monsoon

period as illustrative of the amount of plant food supplied to the rice crop:—

Date of collection of sample.	Parts of Nitrogen in silt per million of water.	Parts of Phosphoric acid in silt per million of water.
29th June 1896	2·86	3·26
5th August 1896	1·23	1·63
8th September 1896	·24	·64
Mean depth of water supplied per acre 8·25 feet	1·44	1·84
Equivalent in lb per acre	32·6	41·7

For the sugar-cane crop.

Date of collection of sample.	Depth of water applied.	Parts of Nitrogen per million of water.	lb of Nitrogen per acre.	Parts of Phosphoric acid per million of water.	lb of Phosphoric acid per acre.
31st December 1896	Jan. 6″ / Feb. 6″	·060	·156	·182	·478
11th May 1896	April 6″ / May 6″	·077	·202	·130	·340
29th June 1897	June 12″	2·86	7·50	3·26	8·54
8th September 1897	Sept. 6″	·24	·315	·64	·839
Total amount of plant food supplied	...	...	8·173	...	10·197

During the rabi season of 1896-97 the amount of silt was so small that it could not be analysed and may be considered *nil*.

It will thus be seen that the amount of silt and its content of Nitrogen and Phosphoric acid are but very small during the cold weather, and quite insufficient to replace the plant food taken from the soil by a crop of wheat. On the other hand, it would appear to be certain that the silt carried on to the land during the monsoon period contains very material quantities of these plant foods. They are probably fully sufficient to replenish the amounts of plant food which are taken from the land by the rice crop.

G. i. C. P. O.—No. 109 R. & A. D.—5-7-97.—2,200.—J. N. D.

S. 2204 a.

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series; those on Forestry in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

This sheet and the title page may be removed when the subject-matter is filed in its proper place, according to the letter and number shown at the bottom of each page.